State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

PEORIA AREA

Peoria, Fulton and Tazewell Counties

Peoria, Canton, Glasford, Dunlap, Elmwood, and Maquon Quadrangles

Leaders
Ed Odom and George Wilson
Urbana, Illinois
September 22, 1962

SPECIAL TRIP

PEORIA GEOLOGICAL SCIENCE FIELD TRIP

Introduction

There is a diversity of geologic features in the Peoria area dating from a million years ago to only a few thousand years ago. Many geologists have studied the region and its geologic problems. It is from their work that most of the text material in this road log is taken.

The glacial history of the area is extremely interesting. Illinoian and Wisconsinan drift mantle the surface and are the parent material for the present soils.

The Shelbyville Moraine, outermost of the succession created by the Wisconsinan glacier, passes through Peoria as does the Bloomington Moraine formed by the Wisconsinan glacier after Shelbyville time.

The downtown area of Peoria and Pekin are located on a terrace eroded by meltwater that poured through Illinois Valley during late Wisconsinan time. This great flood came down the valleys of the Illinois and the Kankakee Rivers during the Valparaiso advance of Wisconsinan time, when the melting ice front stood in southern Michigan and northeastern Indiana. The great quantity of water released over a large area by the wasting glaciers was confined to a narrow outlet channel through the Shelbyville and Bloomington Moraines. The erosive power of the water was tremendous.

Bedrock of Pennsylvanian age (about 250 million years) underlies the glacial drift and outcrops in numerous streams and road cuts. Two commercial coal beds, the No. 5 Coal and the No. 6 Coal, occur in the Pennsylvanian rock sequence in the area.

Pennsylvanian sediments consist of many different rock types, with coal the most outstanding. In Illinois coals are commonly overlain by black sheety shale ("roof slate") followed by limestone with marine fossils. The limestone is usually overlain by gray shale also containing marine fossils. Beneath the coal there is an underclay, in turn sometimes underlain by limestone or shale, then sandstone. This type of rhythmic succession of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian rocks are thickest. Each rhythmic succession of Pennsylvanian rocks is called a cyclothem. An attached sheet shows an ideally complete cyclothem, but all the units are seldom present.

The thickness of the Pennsylvanian System and of the individual cyclothems varies greatly from place to place. An example of this is the interval between the Colchester (No. 2) Coal and the base of the Pennsylvanian. The interval averages about 125 feet in western Illinois, while in the southeastern part of the state this part of the Pennsylvanian column is represented by about 1,200 feet of strata. Although deposition started relatively early in Pennsylvanian time in western Illinois, it either proceeded very slowly or was interrupted frequently by intervals when no sediments were deposited.

The many different rock types in the Pennsylvanian System indicate repeated rapid changes of environment. At that time rivers were bringing sediments from the north and east, possibly as far away as the present Atlantic coast and the region south of Hudson Bay. The Midwest was a low, flat, swampy area lying just a little above sea level but subjected to frequent marine invasions as the land rose or sank, or the sea level raised or lowered. That these conditions existed is evident from the nature of the sediments. Many of the shales, limestones, and ironstones above the coals contain marine fossils. The coals are believed to have formed in broad freshwater marshes somewhat like the present Dismal Swamp of Virginia. Most of the sandstones, conglomerates, underclays, underclay limestones, and some shales probably accumulated in fresh-water environments, such as river valleys, lagoons, lakes, or lowland plains. There is no area in the world today that has conditions exactly like those that existed during "Coal Measures" time.

The plants and trees that grew in Pennsylvanian time were very luxuriant. In the jungle-like growths the plants most common were huge tree ferns that had fronds five or six feet long and grew to a height of more than 50 feet. Along with them were seed ferns, now extinct, giant scouring rushes, and large scale trees which grew to heights of 100 feet or more.

The large scale trees we find preserved in the coals do not have growth rings. The luxuriant growth and lack of growth rings probably indicate that the climate that prevailed at this time was warm and without seasonal change. As the plants fell into the swampy waters, they were partially preserved, buried by later sediments and converted into coal.

Itinerary

0.0	0.0	Assemble at Richwoods Community High School. Turn right (south) on University Street.
1.1	1.1	Traffic signal. Turn right (west) on Glenn Street.
1.0	2.1	STOP. U. S. 150. Turn left (south) on North Sterling Avenue.
1.3	3.4	SLOW. Turn right (west) on Richwood Boulevard.
1.0	4.4	Note glacial till exposed on right.
0.5	4.9	Descending into Big Hollow Creek.
0.3	5.2	SLOW. Turn left across Big Hollow Creek.
0.3	5.5	Note stratified sand underlain by glacial till.
0.3	5.8	Turn left on Route 8.
0.2	6.0	Crossing Big Hollow Creek.
0.3	6.3	CAUTION.
0.2	6.5	Entering city limits of Pottstown.

0.2 6.7 SLOW. Turn right. CAUTION. RAILROAD CROSSING. THREE TRACKS.

0.1 6.8 Pottstown business district.

0.1 6.9 Stop 1. Outcrop of Cuba Sandstone and Canton Shale.

The Cuba Sandstone is the lower unit of the Brereton Cyclothem (No. 1 on illustration of ideal cyclothem). It is underlain by the Canton Shale, the top unit of the underlying St. David Cyclothem.

The Cuba Sandstone at this outcrop is fine grained, thin bedded, and micaceous. Note the well developed ripple marks along the bedding planes. The Cuba Sandstone is approximately 20 feet thick, and the Canton Shale is approximately 25 feet thick.

This is an excellent area to examine channel and non-channel phases of the Cuba Sandstone. Since the next stop will be in a channel phase of the Cuba Sandstone, this outcrop should be studied carefully. The cross section prepared for Stop 2 will clarify the conditions affecting phase occurrences.

The following is a detailed description of the Cuba Sandstone and Canton Shale from <u>Geology and Mineral Resources of the Beardstown, Glasford, Havana, and Vermont Quadrangles</u>, by Harold R. Wanless, ISGS Bulletin 82, 1957.

Canton Shale

The upper part of the Canton Shale consists of two members, a lower gray clay-shale and an upper silty or sandy shale. Together they have a maximum thickness of more than 40 feet. The gray clay-shale is about 25 feet thick. It contains numerous small ironstone concretions, usually not in definite bands. The overlying silty to slightly sandy shale is commonly 10 to 15 feet thick. It grades up into fine sandstone of the non-channel phase of the Cuba Sandstone. The relations are like those where the Purington Shale is overlain by non-channel deposits of the Pleasantview Sandstone.

The Canton Shale is widespread in western and northern Illinois. It is absent south of the Beardstown area for about 100 miles along the western border of the coal basin, where the underclay of the Herrin (No. 6) Coal immediately overlies the St. David Limestone (or calcareous shale).

Cuba Sandstone

The Cuba Sandstone is named from exposures north of Cuba in sec. 8, T. 6 N., R. 3 E., Fulton County, Havana Quadrangle. The sandstone crops out extensively in the Glasford Quadrangle and the north part of the Havana Quadrangle. It is generally resistant to erosion and forms rock ledges or bluffs at many places.

The sandstone is 3 to more than 80 feet thick. A sandstone section of 92 feet is tentatively identified as belonging to this member in a coal test boring in the SE¼ NE¼ sec. 6, T. N., R. 7 E. (about half a mile east of the Glasford Quadrangle), where its base is lower than the Springfield (No. 5) Coal, and it probably cuts out the entire St. David Cyclothem.

Through most of the Glasford Quadrangle and east of Cuba in the Havana and Canton Quadrangles, the sandstone ranges from about 30 to 80 feet thick and varies inversely in thickness with the underlying St. David beds. In the vicinity of Cuba, especially in secs. 8, 19, 20, 21, and 30, T. 6 N., R. 3 E., Havana Quadrangle, the sandstone is less than 5 feet thick and is locally absent, even where its base is only 3 to 6 feet above No. 5 Coal.

The sandstone is commonly light brownish gray and spotted with bright brown specks. It is commonly thin bedded and shaly in the upper part, the beds thickening downward. At many places in the north part of the Havana Quadrangle the sandstone is very evenly bedded in beds 1 to 3 inches thick, resembling a pile of boards.

In channel facies the bedding is less uniform, and massive zones, strongly cross-bedded zones, or shaly zones are found. This variability is comparable with that observed in the channel deposits of the Pleasantview Sandstone. In some channels more than half of the material is shaly, as reported in numerous coal test borings and observed in outcrops in the west half of the Glasford Quadrangle. Some beds are ripple-marked. The texture of the sandstone is fine-grained to very fine-grained. The channel sands on the average are coarser and more poorly sorted than the non-channel sands.

The sandstone consists principally of angular quartz grains, some of which show secondary enlargement. Mica is abundant and feldspar is common. The sandstone contains a relatively small amount of carbonaceous matter as compared to the Pleasantview Sandstone. Zircon exceeds tourmaline by approximately 2:1, and garnet totals 4 percent of the heavy mineral composition. The sandstone is weakly cemented with calcium carbonate, and near the top contains calcareous concretions as large as 2 by 6 by 10 feet, similar to those in the upper part of the Pleasantview Sandstone. At several places thin seams of bright coal up to 4 inches thick are found in the basal 1 foot of the channel sandstone. The base of the sandstone is marked by a prominent unconformity.

Fossil casts of _Calamites_ and _Sigillaria_ are found in the basal parts of the channel sandstone at some places, and leaf impressions are found in sandy shale that probably belongs to this member in the NE¼ NE¼ sec. 21, T. 7 N., R. 5 E., Glasford Quadrangle.

The Cuba Sandstone is well exposed in western Illinois, is especially prominent in the Peoria region, and is equivalent to the Vermilionville Sandstone in northern Illinois. It is absent along the west side of the coal basin from this area south about 150 miles to southern Illinois, where it is again present. It is also present in western Indiana, but seems to be more prominent in northern Illinois than elsewhere in the Eastern Interior Basin.

0.2 7.1 Note Cuba Sandstone at top of cut on right.

0.8 7.9 Note stratified sand on right. On far left is a thick section of stratified sand and gravel overlain by loess.

0.2 8.1 STOP. Illinois 116. Continue straight ahead.

0.9 9.3 Stop 2. Channel Phase of the Cuba Sandstone (Brereton Cyclothem) and underlying St. David Limestone, Black Shale, No. 5 Coal and Underclay (St. David Cyclothem).

Note that the Cuba Sandstone has a markedly different physical appearance and is more than twice as thick as the exposure at Stop 1. The Canton Shale is not present in this outcrop. The sandstone rests on the black shale unit of the St. David Cyclothem, except in one place where there are still a few inches of the St. David Limestone not cut out by the Channel.

The following is a brief geological history of the St. David and Brereton Cyclothems in Western Illinois from Bulletin 82:

St. David Cyclothem

There is no evidence of erosion at the beginning of the St. David Cycle, and no basal sand deposits were laid down in this area. The swamp in which the Springfield Coal accumulated must have simultaneously covered vast areas in Illinois and surrounding states. The clay seams or horsebacks that cut across the coal might have been (1) squeezed up from the underlying underclay, (2) accumulated in cracks or channels in the coal during an emergence just after coal deposition, or (3) washed down into open cracks in the coal and its roof shale and limestone.

Marine invasion began soon after coal deposition in a poorly aerated sea in which black muds and calcareous and pyritic concretions accumulated. As the sea cleared and deepened, light-colored limy muds that made the St. David Limestone were deposited. The St. David sea reached a depth equivalent to the brachiopod phase in the Havana and Glasford Quadrangles and the fusulinid phase in the Beardstown Quadrangle. The change from marine to fresh-water conditions was marked by a progressive increase in clay and decreases in lime and abundance of marine life until the barren Canton Shales were formed. A brief return of marine conditions is recorded in a thin fossiliferous limestone with fossiliferous shales below the middle of the Canton Shale. The St. David Cycle was terminated by another emergence.

Brereton Cyclothem

An extensive system of erosional valleys developed at the beginning of the Brereton Cycle. These valleys cut through the Canton Shale and St. David Limestone, and the valley floors were commonly the black sheety shale or Springfield Coal, but locally were considerably below the coal. The Cuba Sandstone filled these valleys and overspread the uneroded plains. Revival of uplift of the Ozark flank some time after the accumulation of the Springfield (No. 5) Coal is suggested by the wedging out of the Canton Shale, Cuba Sandstone, and Herrin (No. 6) Coal in the Beardstown Quadrangle. The convergence of the No. 5 and No. 6 Coals near Cuba may result from this cause. Near Cuba a brief marine invasion followed the deposition of the Cuba Sandstone, but normally the sand grades upward into typical underclay limestone and underclay. Widespread marshes persisted long enough for the thickest Illinois coal, the Herrin (No. 6), to accumulate. The widespread clay layers in the coal seem more likely to have been distributed by wind than by water, but their lack of interruption by coal stringers poses a problem as to what levelled the swamp just prior to their deposition. The white-top or sandy clay in the upper part of the coal bed may be a deposit in winding tidal channels in the surface of the coal swamp, just after coal deposition had ceased. The initial sea was somewhat better aerated than the initial St. David submergence, as the shale is commonly dark gray and soft, instead of black, hard, and sheety. The Brereton sea may have been deeper and clearer than others, as a fusulinid phase is widespread.

0.2	9.5	Note coal outcropping on right.
0.2	9.7	Note thin Cuba Sandstone at point of spur.
0.0	9.7	Continute straight ahead to Junction 116 on gravel road.
0.3	10.0	Cuba Sandstone outcropping on right.
0.1	10.1	CAUTION. RAILROAD CROSSING.
0.1	10.2	Another channel of Cuba Sandstone overlying No. 5 Coal and black shale.
0.3	10.5	Note large channel of Cuba Sandstone on left.
0.3	10.8	No. 5 Coal outcropping on right just above road level.
0.2	11.0	No. 5 Coal outcropping on right.
0.2	11.2	Railroad underpass.
0.7	11.9	STOP. Junction U.S. 24. Turn right.
0.0	11.9	CAUTION. Traffic signal.
1.0	12.9	Note sandstone with prominent crossbedding outcropping on right.
1.4	14.3	Crossbedded sandstone outcropping on right.
1.2	15.5	Note concretion-bearing shale on right.
0.3	15.8	Turn right on Tuscola Road. Continue south.
0.2	16.0	Stop 3. Outcrop of the Herrin No. 6 Coal, Underclay, and Shale, and the Cuba Sandstone.

Geology is a dynamic science. The processes which formed the present hills and valleys and the extensive mineral resources are as active today as at any time during geological history. A basic geologic principle which guides all geologists in interpretation of geologic history is "the present is the key to the past."

At this stop the numerous gypsum (selenite) crystals in the clay and shale below the Herrin No. 6 Coal are good illustrations of geology in action. The process is proceeding at a rate rapid enough to be perceptible.

Gypsum ($CaSO_4 . 2 H_2O$) is composed of calcium, sulfur, oxygen, and water. Crystals of gypsum are being formed here through chemical reaction. The reaction is as follows:

FeS_2(pyrite) + $7O_2$(oxygen) + $2H_2O$(water) = $2FeSO_4 + 2H_2SO_4$

$FeSO_4 + H_2O = (Fe^{++}) + SO_4$

$CaCO_3 + 2H^+ = Ca + H_2O + CO_2$

$Ca^{++} + SO_4 + 2H_2O = CaSO_4 . 2H_2O$-Gypsum

The reaction is fairly rapid. Gypsum crystals of moderate size can form in a few months. Their rate of growth is dependent on the rate of weathering through which their components are released.

0.3 16.3 Turn around. Return to U. S. 24.

0.2 16.5 STOP. U. S. 24. Turn right.

0.7 17.2 Note sand and gravel terrace deposit on right. Orchard Daniel Chemical Plant on left.

3.1 20.3 Road to Mapleton.

1.7 23.0 Note glacial till overlain by soil and loess.

0.6 22.6 Kingston Mines on left.

5.9 28.5 Banner Mine of the United Electric Coal Company on left. This mine is stripping the Illinois No. 2 Coal which varies from about 3 to 4½ feet in thickness.

1.0 29.5 Turn right on Illinois 9.

0.1 29.6 Stop 4. Discussion of Pleistocene history of the Peoria area and recent changes in classification of the Wisconsinan Stage.

Illinois State Geological Survey Circular 285, "Classification of the Wisconsinan Stage in the Lake Michigan Glacial Lobe," by Frye and Willman contains recent changes in classification of the Wisconsinan Stage.

4.8 34.4 Note gray soil on right. This is a typical soil developed under forest vegetation.

2.2 36.6 Turn right on blacktop road. Olandorf Cemetery.

0.5 37.1 CAUTION. RAILROAD CROSSING.

0.2 37.3 Turn right at Bradley Corner.

1.4 38.7 West entrance to Lake Canton. Follow lake road to picnic area.

2.8 41.5 Exit from Lake Canton. Turn right on blacktop road.

1.4 42.9 Bradley Corner. Continue ahead.

0.8 43.7 Entering Canton on Chestnut Street.

0.5 44.2 STOP. Continue ahead.

0.2 44.4 STOP. Turn right on Illinois 9 and 78.

0.1 44.5 SLOW. Turn left on 78 and 9.

0.3 44.8 CAUTION. Traffic signal.

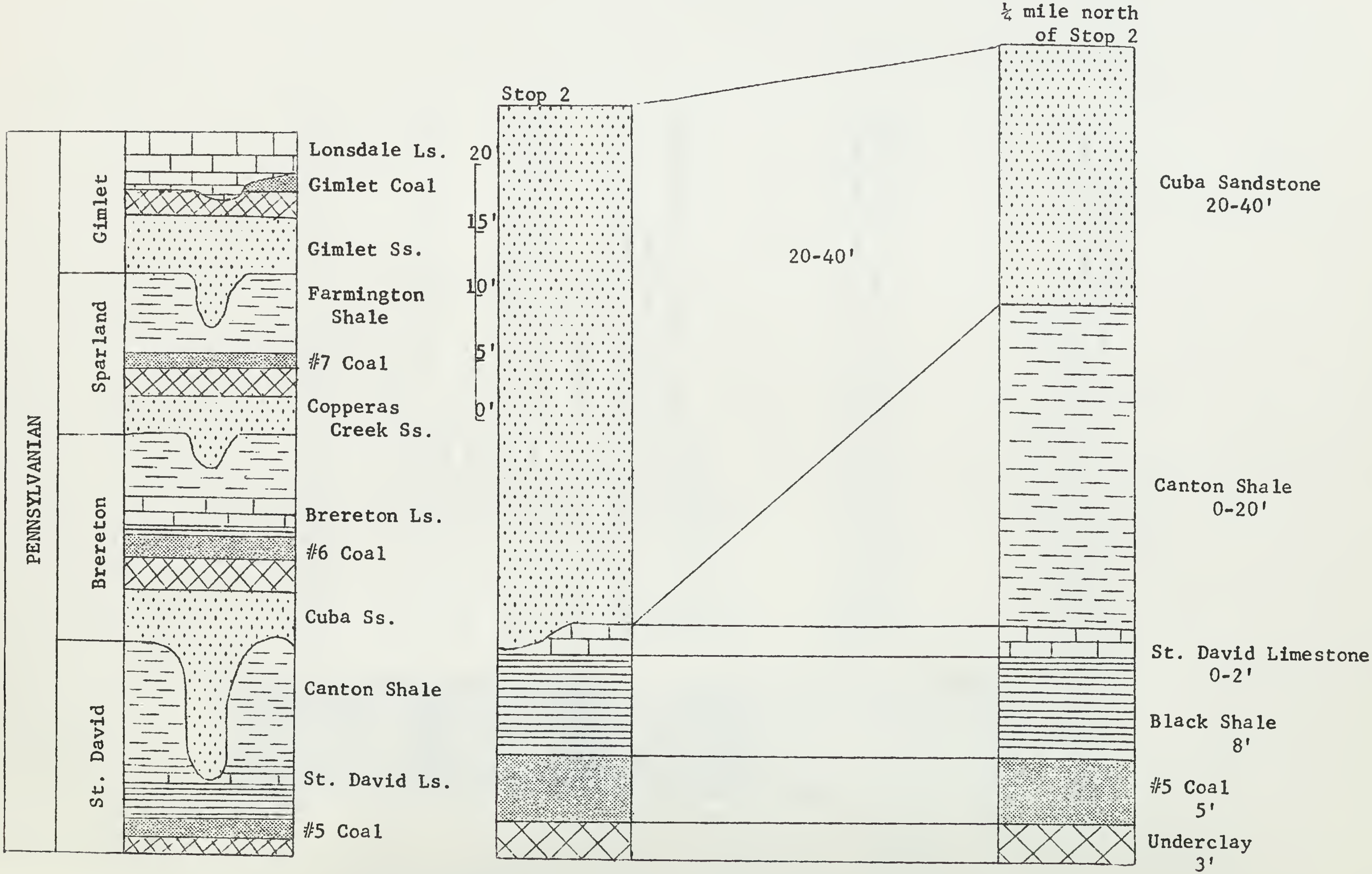
0.1 44.9 Turn right on Illinois 78.

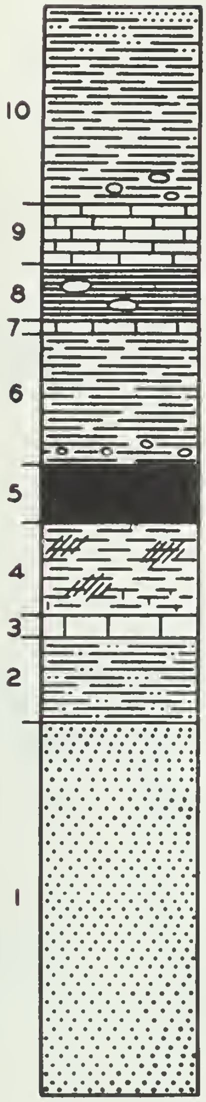
4.6	49.5	SLOW. Turn left on blacktop road on south edge of Morris.
0.3	49.8	Turn left (west) on Fairview Road.
7.2	57.0	Turn right on Illinois 97. Fairview on left.
1.7	58.7	SLOW. Turn left on road to Flamingo Mine.
0.6	59.3	Stop 6. Fossil fauna and flora in strata stripped from over the Illinois No. 5 Coal of the St. David Cyclothem. (Turn around and return to Highway 97.)
0.5	59.8	SLOW. Turn north on Highway 97.
3.6	63.4	STOP. Turn right (east) on Illinois 116.
8.3	71.7	Farmington. Continue on Route 116.
6.2	77.9	Turn left on gravel road at west edge of Trivoli.
0.8	78.7	Stop 7. Quarry in Lonsdale Limestone. (Turn around and return to Highway 116.)

End of Trip

Revised and Reprinted, June, 1965.

Stop 2. Channel Phase of Cuba Sandstone





Shale, gray, sandy at top; contains marine fossils and ironstone concretions, especially in lower part.

Limestone; contains marine fossils.

Shale, black, hard, laminated; contains large spheroidal concretions and marine fossils.

Limestone; contains marine fossils.

Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

Coal; locally contains clay or shale partings.

Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

Shale, gray, sandy.

Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

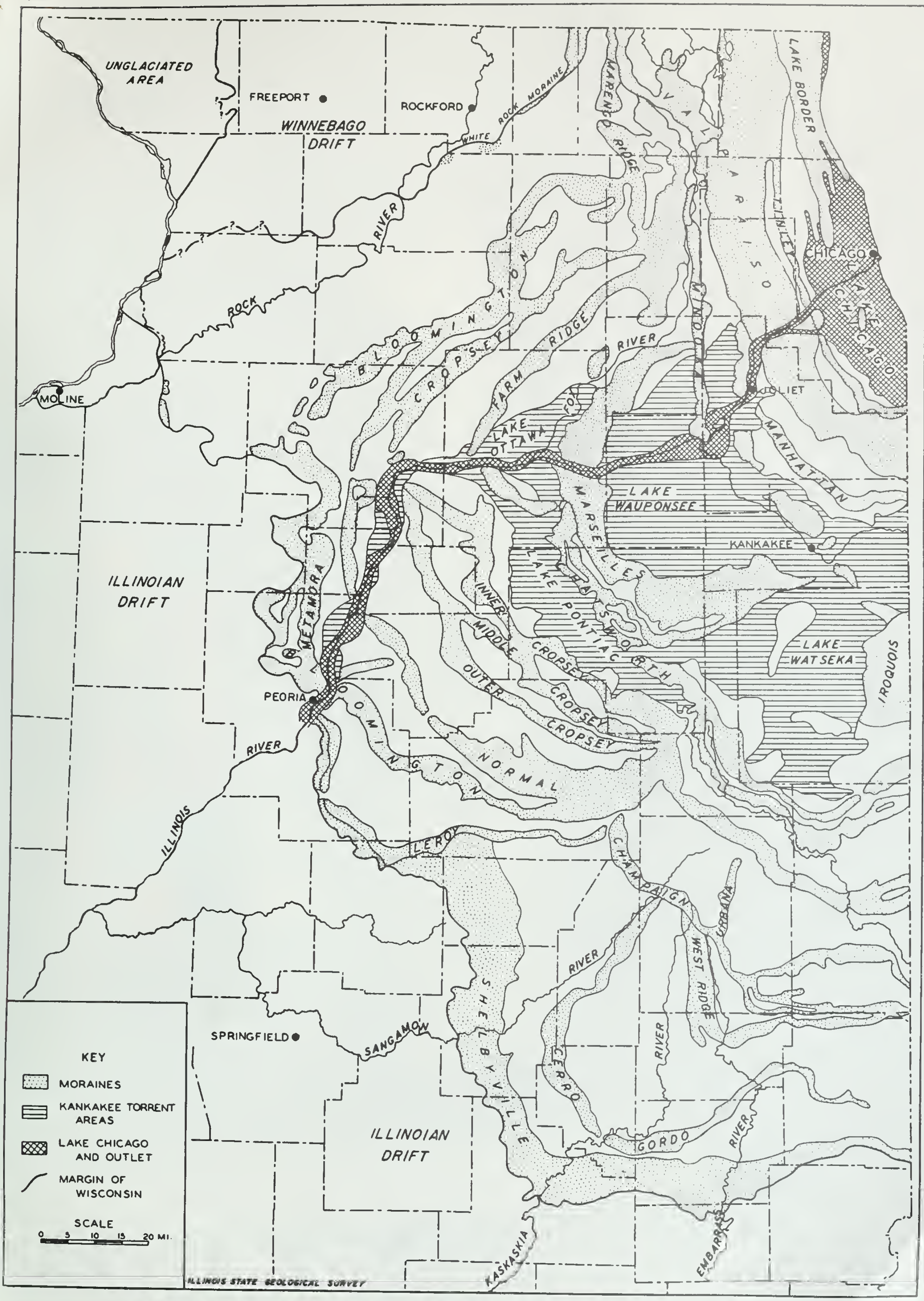
AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

(28197–20M–6/66)

TIME TABLE OF PLEISTOCENE GLACIATION
(Illinois State Geological Survey, 1969)

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
RECENT	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	5,000		
WISCONSINAN (4th glacial)	Valderan	Outwash	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers, Winnebago drift
	50,000 to 70,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
ILLINOIAN (3rd glacial)	Buffalo Hart	Drift	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Jacksonville	Drift	
	Liman	Drift, loess	
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
KANSAN (2nd glacial)		Drift Loess	Glaciers from northeast and northwest covered much of state
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois



GLACIAL MAP OF NORTHEASTERN ILLINOIS

George Ekblaw

Revised 1960